EXTENDED ABSTRACT: Ground-Water Level Data Collected and Maintained by the South Carolina Department of Natural Resources

(Note to editor: The original title of the presentation has changed. Please use the title as shown above. Authors and text remain the same. Thx…Joe Gellici, gellicij@dnr.sc.gov (803-734-6428)

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The South Carolina Department of Natural Resources (SCDNR) collects continuous and periodic ground-water level data from a network of 110 wells—92 in the Coastal Plain Province and 18 in the Piedmont Province. Sixty-two of the wells are equipped with automated data loggers that are programmed to record ground-water levels on an hourly basis; water levels in the remaining wells are manually measured on a bimonthly basis. Data from these wells are used to assess drought conditions, to monitor ground-water availability and the effects of ground-water development, to study interactions between ground water and surface water, and to note changes in horizontal and vertical flow directions.

Wells range in depth from 19 to 3,688 feet. In the Coastal Plain, 2 wells are completed in the surficial aquifer, 13 in the Tertiary sand, 25 in the Floridan, 23 in the Black Creek, 28 in the Middendorf, and 1 in the Cape Fear. In the Piedmont, 4 wells are completed in the saprolite zone and 14 in the crystalline bedrock aquifer. Most of the wells have been monitored since 1999, although a number of stations have been in operation since 1995. Synoptic measurements from a second, larger network of about 600 wells are collected about every five years to produce statewide potentiometric maps of the major Coastal Plain aquifers—Floridan, Black Creek, and Middendorf. Such maps are used to discern long-term trends in ground water storage and to map and evaluate existing and emerging cones of depression. SCDNR also measures specific conductance in five wells along the coast to monitor for saltwater intrusion. Water level data, data reports, and potentiometric maps are available on the SCDNR webpage.

The Hydrology Section of SCDNR was once part of the South Carolina Water Resources Commission (SCWRC), which was formed in 1969. During the 1970s and 1980s, the SCWRC collected ground-water level data for local and county-wide reports and funded the U.S. Geological Survey (USGS) through the Cooperative Water Program to collect water-level data and manage the database. However, no permanent statewide network was ever established. In the mid 1990s, as a result of government restructuring, the SCWRC became part of the SCDNR. It was at this time that the SCDNR began to develop a more systematic approach to monitoring, which included establishing permanent ground-water monitoring stations and installing automatic data recorders (ADRs). Over the years, SCDNR has expanded the network and continues to do so today. The baseline network now consists of 13 stations consisting of 18 wells in the Piedmont Province, and 45 stations consisting of 92 wells in the Coastal Plain Province. There are 62 wells equipped with ADRs and 48 that are manually measured on a bimonthly basis. Eighteen of the stations are well-cluster sites that contain from 2-9 wells. Many of these well-cluster sites were drilled around the outside perimeter of the Savannah River Site for aquifer delineation studies. Cluster sites in the Piedmont region have well pairs completed in saprolite and crystalline rock to study interactions between ground water and surface water and between

saprolite and crystalline rock. Several cluster sites in Beaufort County have wells completed in the Upper and Middle Floridan aquifers to determine the hydraulic connection between these aquifers. Twenty-one of the sites have been cored. Most of the cores were drilled from land surface to bedrock and were drilled for various projects over the years, many in cooperation with the USGS and the U.S. Department of Energy, some dating back to the early 1980s. Cores are useful in delineating the boundaries of the aquifers and confining units at the monitoring station.

A second ground-water level monitoring network was also developed by SCDNR in the mid 1990s called the Synoptic Network. This network consists of wells from the baseline network and additional wells, including municipal, industrial, agricultural, and domestic wells that are measured synoptically, typically in October and November, in order to produce potentiometric maps of the three major aquifer systems in the State. These measurements have generally been made once every five years, but are now being done on a 3-year rotating basis. Currently, 244 Floridan aquifer wells are measured, 148 Black Creek wells, and 167 Middendorf wells. Wells in the network change somewhat from year to year owing to well abandonment, lack of access to wells, and to other unpredictable occurrences. New wells are added to the network as they become available. Floridan aquifer potentiometric maps have been constructed from data collected in 1998 and 2004; Black Creek maps from 1995, 2001, and 2004 data; and Middendorf maps from 1996, 2001, and 2004 data. In November 2009 wells in the Black Creek and Middendorf aquifers were measured and maps are currently being made. In November 2010, new measurements will be made of the Floridan wells.

Data collected from both networks are used to evaluate ground-water trends and changes in ground-water storage, to evaluate ground-water management strategies, to assess drought conditions, to study interactions between ground water and surface water, and to monitor changes in flow direction. As an example, in the 1990s water-level declines in the Middendorf aquifer at Florence were approaching 200 ft from pre-development levels. The Pee Dee Regional Water System went online in 2002, with the capacity of treating 10 mgd from the Pee Dee River. The city is now using a combination of surface- and ground-water sources, and water levels in the Middendorf are beginning to recover.

At the C-10 cluster site in Allendale County six aquifers, ranging in depth from 140 to 1,600 ft, were monitored during the multi-year drought from 1998-2002. Water-level declines were noted in each aquifer and ranged from 1.4 to 13.4 feet over the course of the drought. The deepest well, which was completed in the Cape Fear aquifer, had the smallest overall decline while the Black Creek aquifer had the greatest decline. Hydrographs from well pairs in the Piedmont region indicate a strong correlation between water levels in the saprolite and water levels in crystalline rock, indicating hydraulic continuity between the units. Some of the Piedmont wells, however, show little response to drought, whereas others can fluctuate up to 10 feet. Trends and magnitudes of water levels in the Upper and Middle Floridan aquifers in coastal areas infer hydraulic communication between the aquifers.

The USGS and the South Carolina Department of Health and Environmental Control also collect and maintain ground-water level data in the State. Working together, the three agencies are filling data gaps, sharing equipment and information, and standardizing procedures for

collecting and managing the data with the overall goal of developing a comprehensive statewide monitoring network.